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ARTICLE

Elective single-embryo transfer: persuasive communication strategies can affect choice in a young British population

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Abstract This study tested the effectiveness of the framing effect and fear appeals to inform young people about the risks of multiple births and the option of selecting elective single-embryo transfer (eSET). A non-patient student sample (age (mean ± SD) 23 ± 5.5 years; $n = 321$) were randomly allocated to one of seven groups: (1) framing effect: (1a) gain and (1b) loss frame; (2) fear appeal: (2a) high, (2b) medium and (2c) low fear; or (3) a control group: (3a) education and (3b) non-education. The primary outcome measure was the Attitudes towards Single Embryo Transfer questionnaire, before exposure to the messages (time 1) and immediately afterwards (time 2). Results revealed participants in the high fear, medium fear and gain condition demonstrated the most positive and significant differences ($P < 0.001$ to $P < 0.05$) in their knowledge, hypothetical intentions and modest changes in attitudes towards eSET than the low fear, loss frame and education and non-education messages. The results demonstrate that the use of complex persuasive communication techniques on a student population to promote immediate and hypothetical eSET preferences is more successful at promoting eSET than merely reporting educational content. Future research should investigate its application in a clinical population.

KEYWORDS: eSET, fear appeals, framing effect, infertility, multiple pregnancies, health promotion

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Introduction

According to Lunenfeld and van Steirteghem (2004), multiple pregnancies 'remains one of the most challenging and controversial issues in the treatment of infertility' (2004, pp. 317). In the UK, the Human Fertilisation Embryology Authority (HFEA, 2009) introduced new guidelines that aims to lower the average national multiple birth rate (Code of Practice G.8.5.4—G.8.5.5, HFEA, 2009a) through the elective single-embryo transfer (eSET) policy. The European Society of Human Reproduction and Embryology (ESHRE), in their 2008 position paper, recommended that across countries the 'transfer of three and four embryos should be discouraged' (ESHRE, 2008). This was echoed in the American Society for Reproductive Medicine (ASRM) clinical practice committee report (2009) urging for eSET whether cleaved embryos or blastocysts were transferred.

However, although eSET prevents multiple pregnancies, it may also reduce pregnancy rates, as reported in some (Pandian et al., 2005; van Montfoort et al., 2006) but not all studies (De Neubourg et al., 2006; De Sutter, 2003; De Neubourg and Gerris, 2006), meaning that eSET is not readily embraced by patients or clinicians (van Peperstraten et al., 2008). In a recent review by Leese and Denton (2010), patients in most studies would rather choose double-embryo transfer than single but this was mainly to maximize their chances of achieving a pregnancy and did not necessarily reflect a preference for twins. Nevertheless, some infertile couples prefer twins (Pinborg et al., 2003) so they do not have to go through the uncertain and costly process again to ensure a sibling for their much wanted child (Hojgaard et al., 2007). This supports previous research reporting that a longer time in treatment and having had previous IVF treatments increased the desire for multiple births (Child et al., 2004). These authors reported a 41% preference for multiple births. They also identified that having previous children or recognizing the fetal risks of multiple pregnancies decreases the desire to have these, suggesting education could encourage patients to opt for eSET. A consistent approach educating the population and clinicians to universal multiple pregnancy reduction is needed (Adashi et al. (2003).

Previous studies have found that educating patients of the risk of multiple pregnancies (and benefits of eSET) with extra information leaflets or additional discussion sessions had limited impact in changing couples' attitudes towards eSET (Murray et al., 2004; Ryan et al., 2007). van Peperstraten et al. (2010) developed an extensive empowerment programme which consisted of a decision aid kit, support of a nurse and reimbursement of an additional treatment cycle to persuade patients to choose eSET. Patients who were administered the empowerment strategy were more likely to choose eSET, but the differences between the empowerment and control group was much lower than the estimated goal of 25% based upon power calculations.

There is a need therefore for the development of additional innovative strategies to improve the effectiveness of these health campaigns. The HFEA carried out a preliminary questionnaire study on infertile patients and found that it *is* possible to persuade patients to opt for eSET using a strategy of face-to-face, phone conversation, presentations and/or leaflets effectively (HFEA, 2009b). The framing effect (Kahneman and Tversky, 1979, 1981) and the fear appeal (Hale and Dillard, 1995) are two other strategies often used in persuasive health campaigns, but their effectiveness has not been assessed in eSET.

The framing effect is based on the prospect theory that predicts different preferences for equivalent outcomes that are framed either positively (as gains) or negatively (as losses) (Kahneman and Tversky, 1979, 1981). According to the framing effect, people avoid risks when considering gains, but prefer risks when considering losses even though there should be no systematic preference, as all options offer equivalent contingencies. However, Kahneman and Tversky found that participants were more risk aversive in the positively framed condition whereas participants were more risk seeking in the negatively framed condition. Previous research has found that the framing effect can be successfully applied to change attitudes and intentions towards reproductive health issues (e.g., O'Connor et al., 2005; Purewal and van den Akker, 2009a) and there is potential that this method can be also applied towards intentions towards eSET.

The fear appeal is a widely applied persuasive strategy which has been used to promote and advertise a vast and varied number of products and services, ideologies/political causes and social and personal health issues (LaTour and Zahra, 1988). The fear appeals were founded within the assumption that fear appeals create tension which motivates individuals to adopt recommendations (made in the campaigns) to alleviate the threat (Hovland et al., 1953). Although a number of fear theories have been proposed, many of these posit that differences in the level of fear will lead to differences in the persuasiveness (Witte, 1994; Witte and Allen, 2000). Specifically, studies have found that high fear and high-efficacy messages can be effective in changing some behaviours and attitudes (Morman, 2000; Witte and Allen, 2000).

The aims of this study were to build upon previous policy initiatives and previous randomized controlled trials on patients with marginal success rates (Murray et al., 2004; Ryan et al., 2007; van Peperstraten et al., 2010). Two health campaigns based on the framing effect and the fear appeal to promote hypothetical future intentions to select single-embryo transfer were developed for a non-patient sample. The immediate effectiveness of the two campaigns were assessed using a randomized control trial in students (non-patients). This study is the first of three studies investigating graduated structured eSET promotion. Studies two (underway) and three examine follow-up retention of hypothetical eSET preference in non-patients and actual eSET intention using clinical samples, respectively.

Materials and methods

Sample

In order to recruit a relatively large number of participants necessary to test the efficacy of these communication strategies, an easily available, non-clinical university sample was recruited. The research on non-patients was justified for practical reasons, as step one in a staggered programme

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of studies. A total of 321 randomly recruited non-clinical participants aged between 17 and 48 years (mean ± SD age 23 ± 5.5) participated in the study. The majority were women (67.9%), single (67%) and nulliparous (86.9%). Most were of White (29.3%), South Asian (25.9%) or Afro-Caribbean origin (16.2%) and (90.7%) of the sample were students recruited from a local London (UK) university.

A repeated-measures design was used and participants were randomly allocated to one of two intervention groups (framing condition or fear appeal condition) or the control group (education/non-education). Within each group, participants were further divided into subgroups.

Campaign 1: framing effect

Participants in the framing condition received gain- or loss-framed messages. Gain-framed messages highlighted the benefits associated with selecting eSET by emphasizing the potential health benefits of a singleton pregnancy, whereas the loss-framed messages highlighted the costs associated with not selecting eSET by emphasizing the potential health risks associated with multiple pregnancies. Specifically, in the gain condition, selecting eSET is associated with a positive consequence (singleton pregnancy and health benefits to mother and child). However, in the loss condition, not selecting eSET is associated with negative consequences (multiple pregnancies and health risks to mother and child). The framed messages were developed after reviewing a number of recent examples of framed messages (e.g., Kiene et al., 2005; Purewal and van den Akker, 2009a; Rothman et al., 2006). Written extracts from the gain and loss frame messages are given below. Visual imagery and statistical data were also presented equally in the gain and loss frames.

Gain frames

The health benefits of singleton pregnancy to mothers include: (i) reduced risk of miscarriage; (ii) reduced risk of medical complications including pre-eclampsia, elective and emergency Caesarean, and haemorrhage and anaemia; and (iii) reduced risk of maternal mortality.

The health benefits of singleton pregnancy to babies include: (i) reduced risk of premature birth and low birthweight; (ii) reduced risk of babies suffering from respiratory distress and other health problems including cerebral palsy, disability, congenial malformations and speedier language development; and (iii) reduced risk of baby mortality.

Loss frames

The health risks of multiple pregnancies to mothers include: (i) increased risk of miscarriage; (ii) increased risk of medical complications including pre-eclampsia, elective and emergency Caesarean, and haemorrhage and anaemia; and (iii) increased risk of maternal mortality.

The health risks of multiple pregnancy to babies include: (i) increased risk of premature birth and low birthweight; (ii) increased risk of babies suffering from respiratory distress and other health problems including cerebral palsy, disability, congenial malformations and delay in language development; and (iii) increased risk of baby mortality.

Campaign 2: fear appeal

In the fear condition, participants were exposed to one of three fear messages which varied in the amount of fear they evoked (i.e., highlighting the dangers associated with multiple pregnancies). The conditions included a high, medium and low fear appeal. The fear messages were developed using Hale's and Dillard's (1995) recommendations to pitch them as 'loss framed' to emphasize negative consequences 'for not following message recommendations' (p. 75) as opposed to the framing condition which was positively framed for the gain frame, and all the three fear conditions followed a problem–solution pattern. A problem is presented to readers (i.e., multiple pregnancies), followed by the solution to this problem (i.e., eSET). The problem portion of the message includes the important threat component. Whereas, the solution portion of the message recommends an action component, which is a solution to avoid the threat depicted in the message and demonstrates both response and personal efficacy.

The threat component was developed to arouse the emotion of fear and each of the three conditions varied in the amount of threat depicted. The severity of the threat was documented using message formatting, emotive language, imagery and statistics. The high fear appeal consisted of bolded words, emotive language, a vivid photograph of a live premature child in an incubator and statistics to highlight the dangers associated with multiple pregnancies to evoke fear. The medium fear condition consisted of fewer bolded words, less emotive language, a vivid drawing of a fictional child in an incubator and no statistics to highlight the dangers associated with multiple pregnancies. Whereas, the low fear condition used very little or no bolded words, emotive language or vivid imagery of a child in an incubator and briefly reported the dangers associated with multiple pregnancies with no statistics.

Action components to the messages were related to the behavioural recommendations made in the appeal and this component was designed to demonstrate personal and response efficacy. Personal efficacy refers to the reader's perception of their ability to follow the message recommendations and response efficacy refers to the ability of the message recommendation to reduce the threat depicted in the message. This was achieved by emphasizing the simplicity of deciding to select eSET and the power of the patient's ability to make the correct decision.

With the exception of the threat component, all three conditions included the same personal vulnerability, action, personal and response efficacy components and were all based on the loss frame. See below for written excerpts from the three fear conditions and **Figure 1** for differences in the fear-evoking visual stimuli used in the low, medium and high fear conditions: high fear, a multiple pregnancy is the single greatest health risk to both mother and baby following IVF treatment; medium fear, a multiple pregnancy is the greatest health risk to both mother and baby following IVF treatment; low fear, a multiple pregnancy is a health risk to both mother and baby following IVF treatment.

In attempts to personalize the messages for non-clinical populations, the intervention conditions included the following statement: 'At some point you may be thinking of

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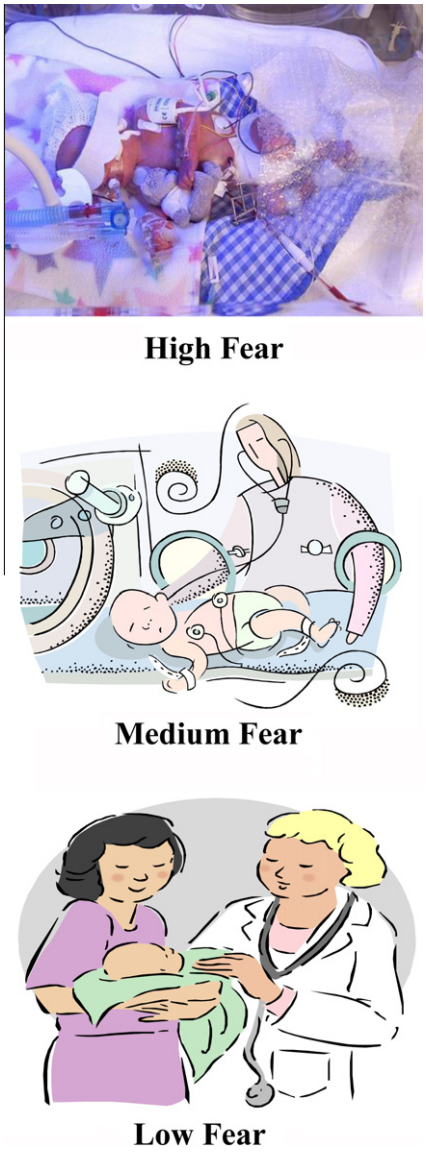

Figure 1 Fear-evoking visual stimuli in the low, medium and high fear elective single-embryo transfer messages.

having children yourself, and most of you will succeed. However, one in seven couples will experience fertility problems and some of these couples will then seek fertility treatment such as IVF.'

Campaign 3: control

In the control group, participants were either exposed to an educational message, which only provided factual information about eSET or non-educational, where no information about eSET was provided. In the non-educational condition, the messages focused on factual information about IVF and no references to eSET or multiple pregnancies were made. The information depicted in both educational and non-educational messages were presented with little or no emotional reference and did not include the 'personalizing' statements which were presented in conditions A and B. See below for samples of the two educational conditions.

Education condition

Approximately one in four IVF pregnancies will result in multiple births (twins or more), hereas only one in 80 will be a multiple pregnancy in naturally conceived babies.

Non-education condition

IVF was first developed in the 1970s and the first IVF baby was born in 1978. Her name was Louise Brown. Since then thousands of babies have been born as a result of IVF in the UK.

The messages (in all conditions) were presented as similar as possible, with the colour and formatting of the messages almost identical. The messages only differed according to the theories underpinning them. All messages are available upon request from the authors.

Questionnaire

The effectiveness of the messages were assessed using the Attitudes towards Single Embryo Transfer questionnaire (adapted from Murray et al., 2004) which measured knowledge, attitudes and hypothetical intentions towards eSET before exposure to the messages (time 1) and immediately afterwards (time 2). The first section of the questionnaire (four items) asks about knowledge of multiple pregnancies in IVF. The second section asks about preference towards having twins (two items). The third section asks about the number of embryos which should be transferred during IVF in principle and in (hypothetical) practice for themselves (two items). The final section focused on attitudes towards the hypothetical acceptability of eSET to couples under different circumstances (six items). Most of the items were 'yes', 'don't know' or 'no' responses, except some items from the first and third section which required participants to select from a list of options.

Procedure

Researchers recruiting the study participants were blind to the condition allocated, with all seven messages stacked in identical message packs and randomly placed in a pile for distribution by the researchers. Message packs included an information sheet, consent sheet, time 1 questionnaire, one of the seven messages, time 2 questionnaire and the debrief sheet and these were handed out unmarked to ensure blinded distribution. All participants completed the Attitudes towards Single Embryo Transfer questionnaire before exposure to the message (time 1) and immediately afterwards (time 2). Power analyses (using G*Power) were used to estimate a minimum sample size and results revealed that to achieve a medium effect size ($f = 0.25$), 251 participants are necessary to provide 95% power to detect a difference at the 0.05 significance level. All non-English speaking participants were excluded from the study.

Ethical approval was granted by the university ethics committee and the project complied with all ethical requirements as stated by the British Psychological Society. Informed consent was obtained from all participants and all participants were fully debriefed.

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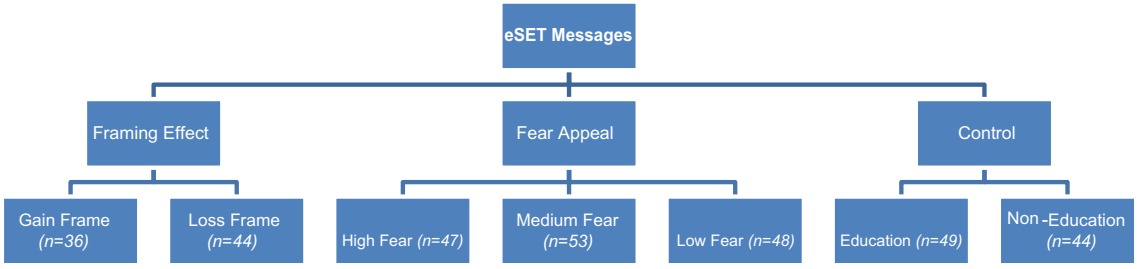

Figure 2 Participant entry into conditions. eSET = elective single-embryo transfer.

Data analyses

Chi-squared tests were performed to compare demographic data and existing knowledge, attitudes and intentions towards eSET at time 1 between participants in the framing, fear appeal and control groups. Individual items were examined across the groups following Murray et al. (2004). Wilcoxon signed ranks tests were used to compare participants' scores on the questionnaire before exposure to the messages (time 1) and afterwards (time 2). Finally, an ordinal logit model was performed to measure which conditions predicted the intention to select eSET in principle and in practice for themselves. A *P*-value of <0.05 was considered statistically significant.

Results

Group comparisons

In the framing campaign, 36 participants were in the gain condition and 44 in the loss condition. In the fear appeal campaign, there were 47 in the high fear, 53 in the medium fear and 48 in the low fear condition. Finally in the Control campaign, there were 49 participants in the education and 44 in the non-education condition (see **Figure 2** for an illustration of participant group allocation). There were no significant socio-demographic differences between participants (in all conditions) on age (F(6,302) = 0.859), gender (chi-squared 6.9, df 6), ethnicity (chi-squared 34.8, df 30),

Table 1 Items on Time 1 questionnaire where participants scored significantly differently.

Item	*Gain frame*	*Loss frame*	*High fear*	*Medium fear*	*Low fear*	*Education*	*Non-education*	*P-value*
Are medical complications during pregnancy and after birth more common in twins?								
Yes	8 (22.2)	12 (27.3)	13 (27.7)	22 (41.5)	18 (37.5)	17 (34.7)	16 (36.4)	$P < 0.01$
Don't know	26 (72.2)	29 (65.9)	29 (61.7)	24 (45.3)	28 (58.3)	22 (44.9)	17 (38.6)	
No	2 (5.6)	3 (6.8)	5 (10.6)	6 (11.3)	2 (4.2)	10 (20.4)	11 (25)	
Would you mind twins?								
Yes	3 (8.3)	7 (15.9)	12 (25.5)	4 (7.5)	2 (4.2)	9 (18.4)	3 (6.8)	$P < 0.02$
Don't know	9 (25)	7 (15.9)	5 (10.6)	18 (34)	15 (31.3)	8 (16.3)	10 (22.7)	
No	24 (66.7)	30 (68.2)	30 (63.8)	31 (58.5)	31 (64.6)	32 (65.3)	31 (70.5)	
How many embryos do you think should be transferred in one go (in principle)?								
1	15 (41.7)	11 (25)	16 (34)	18 (34)	17 (35.4)	14 (28.6)	17 (38.6)	$P < 0.01$
2	5 (13.9)	24 (54.54)	12 (25.5)	12 (22.6)	17 (35.4)	16 (32.7)	19 (43.2)	
3	15 (41.7)	9 (20.5)	19 (40.4)	21 (39.6)	13 (27.1)	18 (36.7)	8 (18.2)	

Values are *n* (%). Some percentages may not correspond to a 100 because of missing data.

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Table 2 Differences in participants' improved knowledge regarding multiple births before and after exposure to the messages.

Item	*Gain frame*	*Loss frame*	*High fear*	*Medium fear*	*Low fear*	*Education*	*Non-education*
Are any of the following associated with infertility treatment?							
Time 1							
Failed fertilization	13 (36.1)	13 (29.5)	15 (31.9)	14 (26.4)	16 (12.5)	17 (34.7)	12 (27.3)
Failed treatment	9 (25)	10 (22.7)	8 (17)	13 (24.5)	11 (22.9)	7 (14.3)	9 (20.5)
Egg overproduction	5 (13.9)	7 (15.9)	15 (31.9)	13 (24.5)	10 (20.8)	10 (2.4)	9 (20.5)
Multiple pregnancy (e.g., twins or triplets)	3 (8.3)	5 (11.4)	8 (17)	7 (13.2)	4 (8.3)	9 (18.4)	5 (11.4)
Inability to produce eggs/spermatozoa	4 (11.1)	5 (11.4)	1 (2.1)	1 (1.9)	1 (2.1)	5 (10.25)	4 (9.1)
Time 2							
Failed fertilization	14 (38.9)	14 (31.8)	18 (38.3)	21 (39.6)	20 (41.7)	13 (26.5)	15 (34.1)
Failed treatment	4 (11.1)	6 (13.6)	2 (14.9)	15 (28.3)	7 (14.6)	7 (14.3)	11 (25)
Egg overproduction	7 (19.4)	10 (22.7)	9 (19.1)	15 (28.3)	8 (16.7)	9 (18.4)	6 (13.6)
Multiple pregnancy (e.g., twins or triplets)	3 (8.3)	6 (13.6)	10 (21.3)	5 (9.4)	6 (12.5)	7 (14.3)	6 (13.6)
Inability to produce eggs/spermatozoa	2 (5.6)	4 (9.1)	2 (4.3)	–	2 (4.2)	6 (12.2)	3 (6.8)
Z score (*P*-value)	−1.49 (NS)	−0.46 (NS)	−0.40 (NS)	−1.31 (NS)	−0.74 (NS)	−0.04 (NS)	−0.24 (NS)
Do people who have infertility treatment, have more twins?							
Time 1							
No	5 (13.9)	5 (11.4)	3 (6.4)	9 (17)	5 (10.4)	9 (18.4)	5 (11.4)
Don't know	21 (58.3)	26 (59.1)	24 (51)	32 (60.4)	26 (54.2)	26 (53.1)	22 (50)
Yes	9 (25)	13 (29.5)	20 (42.6)	11 (20.8)	16 (33.3)	14 (28.6)	17 (38.6)
Time 2							
No	7 (19.4)	6 (13.6)	3 (6.4)	8 (15.1)	2 (6.3)	5 (10.2)	12 (27.3)
Don't know	9 (25)	13 (29.5)	7 (14.9)	12 (22.6)	6 (12.5)	6 (12.2)	12 (27.3)
Yes	19 (52.8)	24 (54.5)	36 (76.6)	30 (56.6)	36 (75)	32 (65.3)	18 (40.9)
Z score (*P*-value)	−1.20 (NS)	−1.81 (NS)	−2.64 (0.00)	−2.45 (0.01)	−3.40 (0.00)	−3.56 (0.00)	−0.99 (NS)
How many fertility-treated pregnancies result in twins?							
Time 1							
1 in 20	13 (36.1)	14 (31.8)	18 (38.3)	22 (41.5)	19 (39.6)	20 (40.8)	16 (36.4)
1 in 10	14 (38.9)	22 (50)	17 (36.2)	15 (28.3)	17 (35.4)	15 (30.6)	16 (36.4)
1 in 4	8 (22.2)	6 (13.6)	12 (25.5)	13 (24.5)	10 (20.8)	13 (26.5)	12 (27.3)
Time 2							
1 in 20	29 (80.6)	29 (65.9)	35 (74.5)	39 (73.6)	34 (70.8)	35 (71.4)	16 (36.4)
1 in 10	4 (11.1)	9 (20.5)	6 (12.8)	4 (7.5)	6 (12.5)	2 (4.1)	11 (25)
1 in 4	2 (5.6)	2 (4.5)	5 (10.6)	4 (7.5)	4 (8.3)	7 (14.3)	15 (34.1)
Z score (*P*-value)	−3.59 (0.00)	−2.82 (0.00)	−3.40 (0.00)	−3.22 (0.00)	−3.47 (0.00)	−2.94 (0.00)	−0.65 (NS)

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Are medical complications during pregnancy and after birth more common in twins?							
Time 1							
No	2 (5.6)	3 (6.8)	5 (10.6)	6 (11.3)	2 (4.2)	10 (20.4)	11 (25)
Don't know	26 (72.2)	29 (65.9)	29 (61.7)	24 (45.3)	28 (58.3)	22 (44.9)	17 (38.6)
Yes	8 (22.2)	12 (27.3)	13 (27.7)	22 (41.5)	18 (37.5)	17 (34.7)	16 (36.4)
Time 2							
No	4 (11.1)	–	4 (8.5)	5 (9.4)	7 (14.6)	6 (12.2)	8 (18.2)
Don't know	8 (22.2)	11 (25)	7 (14.9)	9 (17)	7 (14.6)	5 (10.2)	15 (34.1)
Yes	23 (63.9)	32 (72.7)	35 (74.5)	36 (67.9)	31 (64.6)	33 (67.3)	19 (43.2)
Z score (*P*-value)	−2.71 (0.00)	−3.98 (0.00)	−4.00 (0.000)	−2.68 (0.00)	−1.66 (0.09)	−3.96 (0.00)	−0.97 (NS)

Values are *n* (%). Some percentages may not correspond to a 100 because of missing data. NS = not statistically significant.

parity (chi-squared 32.8, df 36), marital status (chi-squared 20.0, df 24), education (chi-squared 16.2, df 24) or employment (chi-squared 32.7, df 30).

Participants' scores on time 1 of the Attitudes towards Single Embryo Transfer questionnaire were also compared between the seven groups to eliminate any possibility of pre-existing knowledge and attitudes bias towards eSET. Results revealed that with the exception of three items ('Are medical complications during pregnancy and after birth more common in twins?'; 'Would you mind twins?'; 'How many embryos do you think should be transferred in one go (in principle)?') there were no significant differences between scores on time 1, which suggest a low likelihood of attitudinal or existing knowledge bias (see **Table 1** for the items). The differences are evenly spread across groups showing that no particular group was different to the others.

Effectiveness of the messages

Wilcoxon signed rank tests showed that participants in the high fear, medium fear and gain condition demonstrated the most positive change in their knowledge, attitudes and intentions towards eSET. At time 2, in all except the non-education condition, the majority of participants incorrectly reported that 1 in 20 fertility-treated pregnancies results in twins and not 1 in 4.

Framing condition

The gain and loss frame had an equal impact (2/4 items) on changing knowledge towards eSET (**Table 2**) and equally did not change participants' desire for a twin pregnancy (**Table 3**). However, the gain condition was successful in significantly ($P < 0.01$) changing participants' intentions (2/2 items) towards choosing eSET in principle or (hypothetically) for their own treatment, whereas the loss condition demonstrated no impact (**Table 4**). Similarly, the gain condition improved participants' attitudes towards the acceptability of eSET (2/6 items) in certain circumstances but the loss condition did not (**Table 5**).

Fear appeal

The high and medium fear conditions were marginally better (3/4 items) than the low fear condition (2/4 items) in increasing participants' knowledge of the risks associated with multiple births at time 2 (**Table 2**). Just as the framing messages, none of the fear appeal messages influenced participants' preference for twins (**Table 3**). However, the high and medium fear messages significantly (2/2 items; all $P = 0.00$) changed participants' intentions towards eSET in principle and in (hypothetical) practice for themselves, whereas the low fear message only promoted eSET intentions in principle (1/2 items, $P < 0.04$) (**Table 4**). The high and low fear messages were better (2/6 items) than the medium fear message (1/6 items) in changing participants' attitudes towards the acceptability of eSET in some circumstances (**Table 5**).

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Table 3 Differences in participants' preferences towards having twins before and after exposure to the messages.

Item	*Gain frame*	*Loss frame*	*High fear*	*Medium fear*	*Low fear*	*Education*	*Non-education*
Would you mind twins?							
Time 1							
No	24 (66.7)	30 (68.2)	30 (63.8)	31 (58.5)	31 (64.6)	32 (65.3)	31 (70.5)
Don't know	9 (25)	7 (15.9)	5 (10.6)	18 (34)	15 (31.3)	8 (16.3)	10 (22.7)
Yes	3 (8.3)	7 (15.9)	12 (25.5)	4 (7.5)	2 (4.2)	9 (18.4)	3 (6.8)
Time 2							
No	21 (58.3)	29 (65.9)	31 (66)	27 (50.9)	32 (66.7)	29 (59.2)	29 (65.9)
Don't know	9 (25)	10 (22.7)	6 (12.8)	16 (30.2)	10 (20.8)	6 (12.2)	8 (18.2)
Yes	5 (13.9)	4 (9.1)	9 (19.1)	7 (13.2)	2 (4.2)	10 (20.4)	5 (11.45)
Z score (*P*-value)	−1.51 (NS)	−0.74 (NS)	−0.87 (NS)	−0.68 (NS)	−0.71 (NS)	−0.52 (NS)	−1.23 (NS)
Would you prefer twins to no pregnancy at all?							
Time 1							
No	9 (25)	4 (9.1)	10 (21.3)	13 (24.5)	4 (8.3)	8 (16.3)	8 (18.2)
Don't know	8 (22.2)	9 (20.5)	4 (8.5)	9 (17)	13 (27.1)	7 (14.3)	7 (15.9)
Yes	19 (52.8)	30 (68.2)	33 (70.2)	30 (56.6)	30 (62.5)	33 (67.3)	29 (65.9)
Time 2							
No	9 (25)	7 (15.9)	10 (21.3)	11 (20.8)	5 (10.4)	7 (14.3)	6 (13.6)
Don't know	4 (11.1)	9 (20.5)	8 (17)	16 (30.2)	8 (16.7)	4 (8.2)	9 (20.5)
Yes	23 (63.9)	27 (61.4)	29 (61.7)	25 (47.2)	34 (70.8)	36 (73.5)	27 (61.4)
Z score (*P*-value)	−1.19 (NS)	−1.17 (NS)	−0.58 (NS)	−0.75 (NS)	−0.54 (NS)	−0.72 (NS)	−0.24 (NS)

Values are *n* (%). Some percentages may not correspond to a 100 because of missing data.
NS = not statistically significant.

Control condition

The education condition resulted in some improvement (2/4 items) in knowledge (**Table 2**), although like all other conditions, it was also ineffective in changing preference towards having twins (**Table 3**). The education condition did not influence participants' intentions towards eSET (**Table 4**) and decreased the acceptability of eSET (1/6 items) if the costs of treatment were fixed (**Table 5**). As expected, the non-education condition had no influence on participants' knowledge (**Table 2**), preference towards having twins (**Table 3**), intentions towards eSET (**Table 4**) or attitudes towards the acceptability of eSET in different circumstances (**Table 5**). In sum, the changes in attitudes were therefore modest across the framing and fear conditions, but not across the control conditions.

Variables predicting intentions towards eSET

Ordinal logit models revealed that only the high fear (β −0.874; SE 0.407; $P < 0.032$) and gain frame (β −1.047; SE 0.443; $P < 0.018$) successfully predicted the intention to select eSET in principle. Moreover, the high fear (β −1.254; SE 0.415; $P < 0.003$) and gain frame (β −1.182; SE 0.451; $P < 0.009$) messages also successfully predicted the intention to select eSET for their own hypothetical treatment. No other condition had predictive power.

Discussion

The aims of this study were to develop and test two health campaigns promoting eSET based upon the framing effect and the fear appeal and to evaluate their short-term effectiveness in a non/preclinical student population. The effectiveness of short-term high and medium fear appeal and gain frame health communication messages in changing knowledge, intentions and to lesser extent attitudes has been demonstrated, showing that complex communication techniques may be necessary to promote acceptance of eSET. The messages were, however, unsuccessful in changing participants' preference towards having twins, as was found in similar previous research (Murray et al., 2004). The loss frame and the two control conditions were not successful at changing intentions or attitudes, although the loss frame and eSET education condition did improve knowledge. However, it is unknown if these effects are maintained over the longer term or in a clinical population which are currently explored. Nevertheless, these findings mirror the results of Murray et al. (2004) with clinical populations. Smerecnik et al. (2009) also found that educating participants about genetic risk factors did not increase their intentions to engage in preventive behaviours. This implies that to change immediate or short-term intentions and attitudes towards certain health behaviours (e.g., eSET), sophisticated psychological techniques are needed and indeed, as the current results suggest, they are more successful, particularly in changing intentions and to a lesser extent attitudes.

The effectiveness of the gain frame (as opposed to loss frame) to promote eSET is consistent with the prospect theory and the research literature. Specifically, Rothman and Salovey (1997) argued that the framing effect is modified by the type of health related behaviour and the perceived risk involved. Gain frames have been shown to be effective in prevention behaviour which is perceived to be safe and

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Table 4 Differences in participants' intentions towards elective single-embryo transfer before and after exposure to the messages.

Item	*Gain frame*	*Loss frame*	*High fear*	*Medium fear*	*Low fear*	*Education*	*Non-education*
How many embryos do you think should be transferred in one go (in principle)?							
Time 1							
1	15 (41.7)	11 (25)	16 (34)	18 (34)	17 (35.4)	14 (28.6)	17 (38.6)
2	5 (13.9)	24 (54.5)	12 (25.5)	12 (22.6)	17 (35.4)	16 (32.7)	19 (43.2)
3	15 (41.7)	9 (20.5)	19 (40.4)	21 (39.6)	13 (27.1)	18 (36.7)	8 (18.2)
Time 2							
1	24 (66.7)	20 (45.5)	28 (59.6)	28 (52.8)	24 (50)	18 (36.7)	15 (34.1)
2	5 (13.9)	12 (27.3)	10 (21.3)	10 (18.9)	15 (31.3)	12 (24.5)	16 (36.4)
3	7 (19.4)	11 (25)	8 (17)	12 (22.6)	8 (16.7)	17 (34.7)	12 (27.3)
Z score (*P*-value)	−2.542 (0.01)	−1.07 (NS)	−3.00 (0.00)	−2.83 (0.00)	−2.01 (0.04)	−0.98 (0.32)	−0.89 (0.37)
How many embryos would you prefer to have transferred for yourself (if you need infertility treatment)?							
Time 1							
1	15 (41.7)	14 (31.8)	17 (36.2)	12 (22.6)	20 (41.7)	11 (22.4)	16 (36.4)
2	6 (16.7)	20 (45.5)	9 (19.1)	16 (30.2)	14 (29.2)	19 (38.8)	16 (36.4)
3	13 (36.1)	9 (20.5)	20 (42.6)	19 (35.8)	13 (27.1)	16 (32.7)	10 (22.7)
Time 2							
1	23 (63.9)	18 (40.9)	31 (66)	23 (43.4)	23 (47.9)	17 (34.7)	13 (29.5)
2	3 (8.3)	14 (31.8)	9 (19.1)	18 (34)	12 (25)	12 (24.5)	16 (36.4)
3	8 (22.2)	10 (22.7)	7 (14.9)	9 (17)	12 (25)	18 (36.7)	13 (29.5)
Z score (*P*-value)	−2.112 (0.03)	−0.44 (NS)	−3.19 (0.00)	−3.22 (0.00)	−0.59 (NS)	−0.85 (0.39)	−1.13 (0.26)

Values are *n* (%). Some percentages may not correspond to a 100 because of missing data.
NS = not statistically significant.

promotes certainty, whereas loss frames have been shown to be more effective in promoting health detection behaviour because detection behaviour is perceived to be risky (Chang, 2007; Hadden and Delhomme, 2006; Lorez, 2007; O'Keefe and Jensen, 2007; Rothman et al., 2006). eSET is a preventive behaviour (i.e., preventing multiple pregnancies) and studies have found that other preventive behaviours such as doing exercise (Robberson and Roger, 1988) and using sunscreen (Detweiler et al., 1999; Rothman et al., 1993) are best promoted by using the gain-framed message and detection behaviours such as screening for breast cancer (Banks et al., 1995; Schneider et al., 2001) and skin cancer examinations (Block and Keller, 1995) are best promoted using the loss-framed message. The current study effectively applied the framing effect (and fear appeals) in a hypothetical situation using non-clinical populations, consistent with other studies demonstrating that 'real and hypothetical decisions result in similar choices' (Kuhberger et al., 2002, pp. 1170).

The high and medium fear messages were more effective at promoting eSET than low fear conditions. Witte and Allen (2000) conducted a meta-analysis on the effectiveness of fear appeals and reported that stronger fear messages were more persuasive than weaker fear messages, which is consistent with the current findings. However, high and medium fear messages were more effective than the gain-framed messages, which is somewhat unexpected as the fear messages were loss framed. Past research has found that fear messages are more effective when they are framed negatively as losses (Hale and Dillard, 1995; Ruiter et al., 2003). It is possible that high and medium fear-evoking messages eliminated any potential framing effect. For example, recent research has found that presenting participants with warning messages about the potential biasing effect of the messages they are about to read also diminished the framing effect (Cheng and Wu, 2010). However, clearly more research is needed to delineate the finer details of this phenomenon.

A non-clinical sample was used to evaluate the short-term effectiveness of the messages and it is possible that a longer period between time 1 and time 2 assessment and clinical samples may have processed the messages differently. Like most of the persuasion literature (Vakratsas

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Table 5 Differences in participants' attitudes towards the acceptability of elective single-embryo transfer in different circumstances before and after exposure to the messages.

Item	*Gain frame*	*Loss frame*	*High fear*	*Medium fear*	*Low fear*	*Education*	*Non-education*
Would you choose one embryo transfer if this meant a slightly reduced pregnancy rate?							
Time 1							
No	11 (30.6)	13 (29.5)	18 (38.3)	15 (28.3)	12 (25)	13 (26.5)	14 (31.8)
Don't know	19 (52.8)	23 (52.3)	14 (29.8)	25 (47.2)	27 (56.3)	26 (53.1)	22 (50)
Yes	5 (13.9)	8 (18.2)	15 (31.9)	12 (22.6)	8 (16.7)	9 (18.4)	8 (18.2)
Time 2							
No	6 (16.7)	12 (27.3)	15 (31.9)	15 (28.3)	9 (18.8)	19 (38.8)	17 (38.6)
Don't know	15 (41.7)	15 (34.1)	10 (21.3)	13 (24.5)	19 (39.6)	17 (34.7)	13 (29.5)
Yes	15 (41.7)	16 (36.4)	22 (46.8)	24 (45.3)	19 (39.6)	11 (22.4)	13 (29.5)
Z score (*P*-value)	−3.12 (0.00)	−1.17 (NS)	−1.67 (NS)	−1.44 (NS)	−2.42 (0.01)	−0.816 (NS)	−0.54 (NS)
Would you find one embryo transfer more acceptable if this reduced the number of twins?							
Time 1							
No	12 (33.3)	14 (31.8)	20 (42.6)	16 (30.2)	17 (35.4)	17 (34.7)	11 (25)
Don't know	17 (47.2)	18 (40.9)	13 (27.7)	27 (50.9)	24 (50)	24 (49)	22 (50)
Yes	6 (16.7)	12 (27.3)	14 (29.8)	8 (15.1)	6 (12.5)	7 (14.3)	11 (25)
Time 2							
No	5 (13.9)	11 (25)	14 (29.8)	10 (18.9)	12 (25)	19 (38.8)	13 (29.5)
Don't know	16 (44.4)	16 (36.4)	11 (23.4)	18 (34)	13 (27.1)	14 (28.6)	17 (38.6)
Yes	15 (41.7)	15 (34.1)	22 (46.8)	24 (45.3)	21 (43.8)	15 (30.6)	13 (29.5)
Z score (*P*-value)	−2.78 (0.00)	−1.04 (NS)	−2.00 (0.045)	−3.27 (0.00)	−2.84 (0.00)	−0.81 (NS)	−0.33 (NS)
Would you find one embryo transfer acceptable if the success rate was the same as two embryos transfer or more?							
Time 1							
No	3 (8.3)	1 (2.3)	6 (12.8)	1 (1.9)	5 (10.4)	2 (4.1)	3 (6.8)
Don't know	14 (38.9)	19 (43.2)	15 (31.9)	20 (37.7)	15 (31.3)	14 (28.6)	16 (36.4)
Yes	19 (52.8)	24 (54.5)	26 (55.3)	31 (58.5)	27 (56.3)	31 (63.3)	25 (56.8)
Time 2							
No	2 (5.6)	–	1 (2.1)	5 (9.4)	9 (18.8)	5 (10.2)	5 (11.4)
Don't know	12 (33.3)	12 (27.3)	11 (23.4)	18 (34)	16 (33.3)	12 (24.5)	14 (31.8)
Yes	22 (61.1)	30 (68.2)	35 (74.5)	29 (54.7)	22 (45.8)	29 (59.2)	24 (54.5)
Z score (*P*-value)	−0.85 (NS)	−2.50 (0.01)	−2.40 (0.02)	−1.21 (NS)	−1.43 (NS)	−1.25 (NS)	−0.54 (NS)

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If you had to pay for the treatment, would that affect your decision to have one embryo transfer?							
Time 1							
No	9 (25)	9 (20.5)	13 (27.7)	13 (24.5)	12 (25)	10 (20.4)	10 (22.7)
Don't know	14 (38.9)	15 (34.1)	9 (19.1)	14 (26.4)	18 (37.5)	17 (34.7)	17 (38.6)
Yes	13 (36.1)	20 (45.5)	25 (53.2)	25 (47.2)	17 (35.4)	20 (40.8)	17 (38.6)
Time 2							
No	9 (25)	12 (27.3)	18 (38.3)	18 (34)	9 (18.8)	16 (32.7)	10 (22.7)
Don't know	19 (52.8)	12 (27.3)	8 (17)	14 (26.4)	23 (47.9)	15 (30.6)	10 (22.7)
Yes	8 (22.2)	18 (40.9)	21 (44.7)	20 (37.7)	15 (31.3)	17 (34.7)	23 (52.3)
Z score (*P*-value)	−1.25 (NS)	−0.816 (NS)	−1.67 (NS)	−1.41 (NS)	−0.30 (NS)	−1.41 (NS)	−1.04 (NS)
Would one embryo transfer be acceptable if the cost was fixed (regardless of how many times you needed treatment)?							
Time 1							
No	7 (19.4)	6 (13.6)	6 (12.8)	5 (9.4)	5 (10.4)	8 (16.3)	9 (20.5)
Don't know	14 (38.9)	17 (38.6)	13 (27.7)	27 (50.9)	29 (60.4)	18 (36.7)	20 (45.5)
Yes	13 (36.1)	21 (47.7)	28 (59.6)	20 (37.7)	13 (27.1)	21 (42.9)	15 (34.1)
Time 2							
No	5 (13.9)	7 (15.9)	8 (17)	7 (13.2)	6 (12.5)	15 (30.6)	9 (20.5)
Don't know	14 (38.9)	14 (31.8)	13 (27.7)	17 (32.1)	22 (45.8)	17 (34.7)	15 (34.1)
Yes	17 (47.2)	21 (47.7)	26 (55.3)	28 (52.8)	19 (39.6)	16 (32.7)	19 (43.2)
Z score (*P*-value)	−1.26 (NS)	−0.147 (NS)	−0.77 (NS)	−1.21 (NS)	−0.75 (NS)	−2.11 (0.034)	−0.92 (NS)
Would your opinion change if you were charged for the hospital care of premature twins (which is more likely when you have twins or triplets)?							
Time 1							
No	12 (33.3)	12 (27.3)	15 (31.9)	14 (26.4)	15 (31.3)	14 (28.6)	14 (31.8)
Don't know	15 (41.7)	17 (38.6)	14 (29.8)	22 (41.5)	21 (43.8)	20 (40.8)	18 (40.9)
Yes	8 (22.2)	15 (34.1)	18 (38.3)	16 (30.2)	11 (22.9)	14 (28.6)	12 (27.3)
Time 2							
No	14 (38.9)	11 (25)	18 (38.3)	17 (32.1)	12 (25)	14 (28.6)	14 (31.8)
Don't know	14 (38.9)	16 (36.4)	7 (14.9)	15 (28.3)	21 (43.8)	18 (36.7)	10 (22.7)
Yes	8 (22.2)	15 (34.1)	22 (46.8)	19 (35.8)	14 (29.2)	16 (32.7)	19 (43.2)
Z score (*P*-value)	−0.37 (NS)	−0.440 (NS)	−0.08 (NS)	.000 (NS)	−1.11 (NS)	−0.26 (NS)	−1.17 (NS)

Values are *n* (%). Some percentages may not correspond to a 100 because of missing data.
NS = not statistically significant.

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and Ambler, 1999), the effectiveness of the messages were measured immediately after exposure to the messages and no inferences can be made of the retention of changes in knowledge, attitudes and intentions. Therefore a follow-up study is currently underway to measure the longer-term impact of exposure to the messages. This study has demonstrated the potential utility of health-promotion materials for non-patient samples and needs to be tested with a young clinical population, as they are likely to use a similar cost–benefit analysis than couples who have come to the latter stages of their infertility trajectory, who have a longer time of childlessness and have different time pressures to succeed. Issues of participant involvement and prior knowledge (as well as demographic characteristics) between patient and non-patient samples which could influence participants' reactions to the messages need to be explored.

In conclusion, although positive changes in knowledge, intentions and attitudes were observed in the high and medium fear appeal and gain frame messages, the changes remained modest. The desire for having children is inherent and strong for clinical and non-clinical populations (Edelmann et al., 1994; Langdridge et al., 2000; Purewal and van den Akker, 2007, 2009b). The research literature suggests that eSET is only acceptable for patients, if it does not reduce their chances of having a child (Leese and Denton, 2010). Educating patients (Murray et al., 2004; Ryan et al., 2007) or providing them with empowerment programmes and financial incentives or reimbursements for extra treatment (van Peperstraten et al., 2010) have limited success in changing intentions or uptake of eSET. It is likely that any intervention which is believed to reduce a person's chances of conceiving will be met with resistance, and until knowledge of success rates of eSET as reported by, for example Khalaf et al. (2008), are more widely accepted, more sophisticated persuasion is needed.

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